UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

45849

Mr. Joel Karmazyn
E.I. du Pont de Nemours & Company
300 Bellevue Parkway, Suite 390
Wilmington, DE 19809-3722

Date: 10/7/92

Dear Mr. Karmazyn:

The Environmental Protection Agency (EPA) notifies E.I. du Pont de Nemours & Company (Du Pont) that the following documents:

1. Risk Assessment: Volume II (Environmental Evaluation) 8/7/92

2. Remedial Investigation Report: Volume I & II 8/27/92

3. Focused Feasibility Study: Volume I & II 8/27/92

have been approved (the approval for the Focused Feasibility Study applies only to the two volumes submitted on 8/27/92 and to Appendix F dated 9/11/92). Attached are comments for each document which EPA believes are necessary to document differences in the data interpretation or to clarify certain issues and are necessary to approve the documents "as is." Therefore, the comments will be attached to the documents in the Administrative Record.

If you have any questions regarding this matter, please call me at (215) 597-0978.

Sincerely,

Randy Sturgeon

Randy Sturgeon
Remedial Project Manager
DE/MD Section

cc: Brandt Butler
Peter Ludzia (w/o attachments)
Wayne Walters (w/o attachments)
Anne Hiller
Karl Kalbacher
Peter Jacobson

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Risk Assessment: Volume II (Environmental Evaluation) 8/7/92

DATE: 9-30-92

FROM: Randy Sturgeon, RPM
DE/MD Section, (3HW42) Randy Sturgeon

TO: File

Upon review of the above document, EPA has concluded that no further revision by Du Pont is necessary. However, EPA believes it is necessary to add the following comments to the documents to clarify several issues and/or express EPA's view point on several issues.

1) Executive Summary, page ES-2, bullet 1: The use of the word "apparently" is inappropriate. Measurable ecological endpoints indicate that parts of the Site have definitely been impacted. The use of the word "apparent" leads the reader to believe that there is doubt in the author's mind. In fact, EPA believes that when discussing impacts, it is better to look at areas that show Site-related contamination. However, EPA also believes that it is appropriate at this Site to examine measurable ecological endpoints (at this Site, the most common endpoints were elutriate and solid phase toxicity tests and benthic organism studies) to determine when and where remediation is appropriate.

2) Section 2.2.1, page 2-4, paragraph 1: EPA's analysis of the 1937 aerial photograph has drawn several different conclusions. Wetlands did exist to the southwest of the north disposal site along the Christina River. Also, there was a drainage way to the river present at that time.

3) Section 2.2.2, page 2-8, paragraph 3: The 1973 aerial photograph shows an excavation which became the south pond by 1977. The purpose of the excavation is not known. However, it did occur around the time when DelDOT dumped dirt from the 141 bridge ramp excavation on the south landfill.

4) Section 2.2.5. age 2-18: A fox, a beaver dam, and muskrat lodges have also been observed.

5) Section 3.6.5, page 3-14, paragraph 5: Vegetation tissue analyses of spatterdock collected from the south disposal site not only suggest, but definitively show that levels of Site-related metals are much higher in spatterdock plant tissue at the Site as compared to the reference station.

6) Section 4.3.2.1, page 4-8: EPA believes that the statement "the more recent data that were validated by more rigorous QA/QC standards" is unsubstantiated and that the argument as to why Phase II arsenic data should be discarded in preference with Phase III data is not valid. However, upon EPA review of the data, it does appear that Phase III and Supplemental Phase III arsenic data are more consistent. For example, AS01 and AS03 were sampled in each of the three rounds with Phase III and Supplemental Phase III data being in agreement and being an order of magnitude lower than Phase II data. At AS07, while arsenic was high in both Phase II and Phase III, Phase III arsenic was slightly lower even though all of the other contaminants were much greater, indicating that the Phase II arsenic analysis was biased high. At RS04 (at one time used as the sediment reference station and having Site-related contaminant levels very close the reference station RS15), arsenic was two orders of magnitude higher in Phase II compared to Phase III, but the Phase III arsenic is the more reasonable analysis when compared to the levels of the other contaminants. In light of this, EPA agrees with Du Pont using the Phase III arsenic data in the terrestrial risk assessment and agrees with the conclusions regarding the inaccuracy of the Phase II arsenic data.

7) Section 4.3.2.3, page 4-14, paragraph 2: Although EPA agrees that high arsenic levels measured in the river in Phase II were not confirmed by later sampling, EPA does believe that the data discussed in this section do indicate that the Site has been releasing arsenic to the river especially since arsenic is also high in the north drainage way (AS07). The 6"-12" sample at RS15 just barely exceeds the TVG value and is only one-fourth the level detected at RS11, and therefore EPA does not believe that the data from RS15 indicate that arsenic is a ubiquitous contaminant in the Christina River.

8) Section 4.5, page 4-26: While EPA agrees with the discussion about the different competing fate-and-transport mechanisms, EPA does not agree with the spirit of this section where Du Pont attempts to communicate that the seeps are not a problem. No matter what happens to the metals, they contribute to impacts. If they precipitate out of solution, they contribute to an already excessive sediment chemistry problem. If they stay in the water column (either dissolved or bound to organic particulate), they contribute to Ambient Water Quality Criteria (AWQC) exceedances. In both cases the seeps are contributing to

adverse impacts to aquatic life. It should also be noted that Du Pont's calculations regarding the effect of Site-related ground-water discharges to AWQC exceedances (pages 4-28 and 4-29) show (assuming they are representative) that although the Site may not create by itself AWQC exceedances, the Site does significantly increase contaminant levels in the river. For example, Du Pont calculated that the Site-related zinc contribution to the river increased the zinc level in the river by over 30 ppb. When the AWQC is only 110 ppb (at 100 ppm hardness), 30 ppb is a significant amount. Controlling the groundwater from the Columbia aquifer and the fill zone at the Site would significantly improve the water quality in the Christina River. It should also be noted that the loadings presented in the EE are much lower than those Du Pont presented in the Data Sufficiency Memorandum (4/27/89). At this time EPA has not determined which it believes are most accurate.

9) Section 4.6.1, page 4-32: EPA continues to assert that the elevated levels of metals detected in the silvery minnow are caused by the Site. If natural occurring variances where the cause of the differences between levels at different sampling areas, then some of the Site-related contaminants would be higher at the reference area while some would be higher at the Site vicinity. However, almost all Site-related contaminants (barium, chromium, copper, lead, manganese, nickel, and zinc) are higher at the Site-vicinity than at up-stream areas either in the Christina River or in White Clay Creek.

10) Section 5.3, page 5-3: EPA considers arsenic to be a contaminant of concern. AS07, RS11, and RS12 do have elevated levels of arsenic. These are also areas that show toxic impacts which warrant remediation and which have elevated levels of other Site-related contaminants. Arsenic is also a contaminant of concern in the HHE because of elevated levels in the soil and the ground water. See the attached ecotoxicological profile for arsenic.

11) The following comments relate to the terrestrial risk assessment.

A) Section 6.1.2, page 6-6: Du Pont provided no information to substantiate the statement "spatterdock may be atypical in its ability to bioaccumulate metals such as barium in its rhizomes." Du Pont appears to have made this statement in an effort to show that the uptake of barium in spatterdock at the Site may not be indicative of other plants at the Site with the implication being that other plants may have a lower uptake. Spatterdock may or may not be atypical. It also may underrepresent the amount of uptake by other plants at the Site.

B. Section 6.3.2, page 6-15: One weakness with using the hazard index methodology for calculating risk is that it does not take into account the accumulation efficiency of a contaminant. Accumulation efficiency can only be evaluated indirectly with toxicity tests, or through tissue analyses. Several ways to overcome this weakness are to use more conservative assumptions for the risk assessment and/or to do field monitoring.

C. Section 6.3.2, page 6-18, paragraph 4: Du Pont's statement that laboratory animals are more susceptible to toxic effects of chemicals than wildlife is unsubstantiated.

D. Section 6.3.2, page 6-19, paragraph 2: EPA believes that it would be more appropriate to use toxicity data of methyl mercury to determine the screening intake value for mercury because bacteria in the sediments could methylate the inorganic mercury that was originally deposited.

E. Section 6.3.2, page 6-19, paragraph 3: EPA believes Du Pont was not conservative in its assumption that all of the barium which muskrats are exposed to is barium sulfate. EPA agrees that the barium in the sediments is barium sulfate. However, the barium in the plants is, in all likelihood, not barium sulfate. The barium had to be in a soluble form to be absorbed by the plant. Some plants may have ways of tying up the barium to prevent phytotoxic effects, but this does not mean that the barium is not bioavailable to animals that eat the plants. EPA believes that it would be more appropriate to use toxicity data for soluble forms of barium (such as barium chloride) for the portion of the calculation involving ingestion of plant tissue. Also, see attached discussion.

F. Section 8-1, page 8-1: The results of the sensitivity analysis show that the Hazard Index for the terrestrial risk assessment for muskrats is greatly dependent on which toxicity values are used. Use of conservative toxicity values alone or in conjunction with more conservative assumptions for the matrix effects factor and diet sediment content produces Hazard Indices that indicate severe impact to muskrats. Due to the lack of guidelines regarding the kinds of assumptions that would be appropriate in this type of risk assessment, EPA feels that monitoring muskrats at the south pond during RD/RA would help determine if muskrats are experiencing adverse impacts to such an extent that remediation of the south pond would be warranted in the future.

12) Section 6.2.3, page 6-7, paragraph 3: It should be noted that there is still heavy contamination at AS05 in the south wetlands. Barium has an enrichment factor (EF) of 103, zinc has an EF of 11, and lead has EF of 9.

13) Section 6.2.4, page 6-8, paragraph 1: Review of the river sediment chemistry data shows that elevated levels of Site-

related contaminants have been detected as far downstream as RS08. Also, a portion of the river immediately up-stream may also be contaminated due to the tide. No sampling during the RI was done immediately up-stream of the Site.

14) Section 6.3, page 6-10, paragraph 1: The wording concerning the value of the habitat gives the impression that the Site is not a valuable habitat. EPA disagrees. The Site has a nice combination of terrestrial, edge, wetland, and aquatic/tidal habitats with good density, abundance, and diversity.

15. Section 7.6, page 7-9, paragraph 1: The river sediment chemistry data **does imply** that the river has been impacted at least from RS01 to RS08 and that the impact is continuous between these two points.

16) Section 7.6, page 7-9: It should be noted that RS07 had zero percent survivability of water fleas in the elutriate toxicity tests.

17) Section 7.6, page 7-9, paragraph 2: It should be noted that RS01 had the same survivability rate as RS07 in the solid phase toxicity test using *Chironomus*.

18) Section 7.7, page 7-12, paragraph 2: EPA does not agree with Du Pont's assumption that "overall ecological impact within the South Disposal site wetlands is........... minimized." There is substantial area between AS03 and AS05 which may have benthic communities which are stressed due to the high level of contamination present.

19) General Comment: It should be recognized that no pristine areas near the Site were available to use as a reference station. Comparing Site sampling stations to a stressed reference station does not adequately show the amount of stress to the environment occurring at the Site. EPA believes that even if there were no non-Site related contributors of contamination to the Site (especially the river), the same level of contamination and impact would measured.

## Ecotoxicological Profile - Arsenic

Freshwater plant data suggest that concentrations of arsenic which are toxic to aquatic plants are also acutely toxic to aquatic invertebrate species. Ambient temperature is directly related to arsenic toxicity (Eisler, 1988).

Arsenicals can be toxic to plants, but the biochemical basis for the toxicity is not well understood. Symptoms of arsenic toxicity in plants include wilting, chlorosis, cessation of growth, and gradual browning. However, such impacts can be mediated by a variety of soil conditions including soil type, pH, and the presence or absence of other soil nutrients. None of six food crops tested grew when soil concentrations exceeded 500 ppm arsenic. However, at 10 - 100 ppm arsenic, crops grew in proportion to the concentration. The concentration of arsenic in soils at which yield decreases were first noted for vetch, oats, and barley were 94, 1898, and 283 ppm, respectively. However, lower arsenic concentrations may be beneficial to plant growth (NAS, 1977).

In most animals, arsenic poisoning is exhibited by acute or subacute signs. Symptoms of acute arsenic toxicosis reported in mammals are intense abdominal pain, staggering gait, extreme weakness, trembling, salivation, vomiting, diarrhea, fast and feeble pulse, prostration, collapse, and death. Observations of subacute episodes of arsenic poisoning (where animals live for several days) include descriptions of depression, anorexia, increased urination, dehydration, thirst, partial paralysis of rear limbs, trembling, stupor, coldness of extremities, and subnormal body temperatures (Eisler, 1988).

Chronic exposure to inorganic arsenic has produced weakness, paralysis, conjunctivitis, dermatitis, decreased growth, and liver damage in mammals. Chronic exposure to organic arsenic has been associated with demyelination of optic and sciatic nerves, depressed growth, and decreased resistance to infection (Eisler, 1988). Oral chronic administration of arsenic to rats resulted in enlargement of the bile duct (ATSDR, 1991). Because of the body's ability to detoxify and excrete arsenic, chronic poisoning is infrequently observed (Eisler, 1988). Other adverse non-carcinogenic effects on mammals include liver injury, teratogenesis, and embryotoxicity (Klaassen et al., 1986). Parenteral administration of relatively high doses of arsenic have produced teratogenic effects in many mammal species including mice, rats, and hamsters. Sufficient evidence to establish arsenic as a human teratogen is not available (NAS, 1977). Arsenic has been established as a human carcinogen following chronic oral exposure (Klaassen et al., 1986).

Signs of arsenic poisoning in avian species include slowness, jerkiness, falling, hyperactivity, fluffed feathers, drooped eyelids, huddled position, immobility, and seizures. Mallards (*Anas platyrhynchos*) administered arsenic in a single oral dose exhibited regurgitation and excessive drinking. This experiment yielded an estimated $LD_{50}$ of > 2,400 mg As/kg (Eisler, 1988).

Adverse effects of arsenic on aquatic organisms have been reported at concentrations as low as 19 to 48 $\mu$g/L in water, 120 mg/kg in diets, and 1.3 to 5 mg/kg fresh weight in tissues (Eisler, 1988).

The concentration that is lethal to 50% of the test population ($LC_{50}$) was estimated as 3800 $\mu$g/L for *Daphnia magna* (AQUIRE, 1992). A concentration at which 50% of the test population exhibits adverse effects ($EC_{50}$) was established (based upon death and malformations of embryos and larvae) as 4450 $\mu$g $As^{3+}$/L for Marbled Salamanders (*Ambystoma opacum*) exposed for 8 days (USEPA, 1984). Minnows exhibited a loss of equilibrium after 36 hours of exposure to 20 mg $As^{3+}$/L. Concentrations of $As^{3+}$ considered effective for aquatic weed control were harmful to several species of freshwater teleosts including Bluegills, Flagfish, and Fathead Minnows. Finfishes exposed to 1 to 2 mg total As/L for 2 to 3 days showed one or more of the following signs: 1) hemorrhagic spheres on gills; 2) fatty infiltration of the liver; and 3) necrosis of the heart, liver, and ovarian tissues (Eisler, 1988). Chronic $As^{3+}$ exposure caused population reduction and immobilization in *Daphnia sp.*, and decreased survival and histopathological alterations in Bluegills (*Lepomis sp.*) (USEPA, 1984).

Chronic exposure to concentrations of $As^{5+}$ resulted in immobilization and reproductive impairment in *Daphnia sp.*, and a reduction in acetylcholinesterase levels in Fathead Minnows (*Pimephales promelas*). Channel Catfish (*Ictalurus punctatus*), exposed to 15,000 $\mu$g $As^{5+}$/L for 6 months exhibited ultrastructural changes in the liver. Green Sunfish (*Lepomis sp.*) developed arsenic inclusions in the liver, following chronic exposure to $As^{5+}$ (USEPA, 1984). Experimentally derived maximum bioconcentration factors (BCFs) for aquatic organisms for $As^{3+}$, $As^{5+}$, and organo-arsenic were 17, 6, and 9 respectively (Eisler, 1988). A BCF range of 1.2 to 4.4 was given for Bluegills (AQUIRE, 1992).

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[redacted]

**Bioavailability of Barium Sulfate**

The EPA Drinking Water Criteria Document on Barium (USEPA, 1990) summarizes numerous barium toxicology studies, including a study of the influence of the specific barium salt anion on barium absorption in mammals. This study (McCauley and Washington, 1983) compared the relative absorption rates from the GI tract of barium sulfate, barium chloride, and barium carbonate. The following is an excerpt from the EPA document:

*"It is interesting to note the relatively high blood concentration of barium after administration of $BaSO_4$, a relatively insoluble compound at pH 7.0 (as indicated by the presence of the precipitate in the solution). These results appear to indicate that even $BaSO_4$ may be relatively easily absorbed from the GI tract."*

This finding tends to contradict statements by DuPont that barium sulfate is [redacted] non-bioavailable. Although gastrointestinal absorption of barium varies with species, age, and contents of the gastrointestinal tract (USEPA, 1990), the literature indicates that barium sulfate can be absorbed.

**Trophic Transfer of Barium in Plants**

A survey of the available literature indicated that barium is accumulated by a variety of plants (Reeves, 1986; USEPA, 1990). Based on the results of spatterdock sampling at the site, it appears that spatterdock accumulates barium. Because barium is not toxic to spatterdock, it appears that the plant prevents barium from entering the circulation (where it might disrupt enzyme function) possibly by either extra-cellular or intracellular localization (Fitter and Hay, 1981). It is possible that barium is stored in the spatterdock cell wall, as DuPont suggests (page 5-11), and barium ions stored in the cell wall may be less bioavailable than barium ions in solution. However, DuPont has already accounted for this in their assumption that barium in food is less bioavailable than the discrete compounds administered to laboratory animals.

Contrary to the text of the EE, there is no evidence that there is any qualitative difference between barium ions in plants and barium ions anywhere else. The $Ba^{2+}$ ion is a highly toxic muscle poison that causes gastrointestinal, cardiac and skeletomuscular stimulation and then paralysis (Reeves, 1986). In the EE, it is noted that the National Academy of Sciences recommends that the level of soluble barium in a domestic animals diet should not exceed 20 ppm (page 5-10). The concentration of barium in spatterdock at the reference station and at the site are above this level; but the spatterdock at the site contains concentrations more than an order of magnitude higher than at the reference station (up to 7600 ppm barium). It has not been established that the barium in spatterdock is in an insoluble form. All that can be assumed is that barium has been localized, not that it is in an insoluble form or that the localization mechanism renders the barium non-bioavailable to herbivores. There is no scientific evidence in the literature to support the statement on page 7-6 "barium in the sediment and vegetation is present in a nontoxic form".

**Ecological Risk Characterization for Barium in the EE**

Several concerns remain about the data used by DuPont to develop the hazard index scores for barium. The hazard index is a ratio between the estimated site exposure level and an exposure level that is expected to be without adverse effect (DuPont calls this exposure level a screening intake value (SIV)). When the hazard index ratio is greater than one, risk may be present. The more the hazard index exceeds one, the greater are the chances for elicitation of toxic effects.

EPA requested DuPont to conduct a sensitivity analysis of the EE results using the lowest available SIV. Based on a comparison between Table 25, where all SIVs are listed, and Table F-23, where the SIVs used in the sensitivity analysis are listed, DuPont did not use the lowest SIV presented in the revised EE for the barium hazard indices (risk estimates) in the sensitivity analysis.

DuPont calculated a number of SIVs for barium: the lowest was 0.051 mg/kg-BW day (see Table 25, the list of SIVs). However, in conducting the sensitivity analysis, DuPont used an SIV value of 1.0 mg/kg-BW day as the "lowest" SIV (see Table F-23).

The value of 1.0 mg/kg-BW day for a barium SIV does not appear in the DuPont EE. However, if the lowest reported barium SIV in Table 25 were used, there would be a dramatic increase in the barium hazard quotients for all receptors (factor of 20).

For example, the correct value for the most conservative estimate of a barium hazard quotient for soil ingestion for a mouse in the South Disposal Site is **118.4**, (not 6.0435). The correct barium soil hazard quotient would be calculated as follows:

<u>6.040 mg/kg-BW day</u> *(intake: Table F-23)*
0.051 mg/kg-BW day *(lowest Ba SIV: Table 25)*.

Added to the very high hazard quotients for the mouse at this location due to lead and other contamination, the conservative estimate of a total mouse hazard index for the South Disposal Site is **227**.

Similar extremely high hazard indices will be shown for each receptor if the lowest Ba SIV is used as directed by EPA (eg muskrat barium in food hazard quotient, South Disposal site is 6.72 *(uptake)*/0.051 *(SIV)* or **131.7**).

It should be noted that in risk assessment all routes of exposure and site locations are customarily added to produce the site hazard index for each receptor. The EE segregates each specific hazard index by location. This non-standard presentation mistakenly suggests low risks relative to other sites.

As noted in previous comments, it is not possible to make a comparison between toxic effects reported in the literature and the "screening intake values" calculated by DuPont. (The screening intake values are presented in mg/kg-BW/day, while literature values are in mg/kg: the parameters necessary to make the conversion have not been provided). Therefore although there are numerous toxicity values for various barium salts reported in the literature, it is not possible to determine if DuPont's values are similar. One can only assume that the SIVs presented are representative of the values in the literature. Due to this uncertainty, it is especially important that the lowest SIV reported by DuPont be used for the sensitivity analysis.

**Fate and Transport of Barium**

The excerpt on barium from a 1985 report on properties of hazardous substances (attached) appears to provide the best available discussion of the environmental fate and transport of barium sulfate.

According to this report, large amounts of barium "will not dissolve because natural waters usually contain sulfate, and the solubility of barium sulfate is generally low. Barium is not soluble at more than a few parts per million in water that contains sulfate at more than a few parts per million. However, barium may become considerably more soluble in the presence of chloride and other anions" (Clement, 1985).

# REFERENCES

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USEPA. 1990. Drinking Water Criteria Document on Barium. PB91-142869. December, 1990.

# BARIUM


Summary

In its pure form, barium is an extremely reactive metal that decomposes in water. In natural waters it forms insoluble carbonate or sulfate salts and is usually present at concentrations of less than 1 mg/liter. Insoluble forms of barium are not very toxic; but soluble barium salts are highly toxic after acute exposure, and they have a prolonged stimulant effect on muscles. A benign pneumoconiosis, baritosis, can result from inhaling barium dusts. The EPA Interim Primary Drinking Water Standard is 1 mg/liter.


CAS Number: 7440-39-3

Chemical Formula: Ba

IUPAC Name: Barium

## Chemical and Physical Properties

Atomic Weight: 137.3

Boiling Point: 1,640°C

Melting Point: 725°C

Specific Gravity: 3.5

Solubility in Water: Decomposes; combines with sulfate present in natural waters to form $BaSO_4$, which has a solubility of 1.6 mg/liter at 20°C

Solubility in Organics: Soluble in alcohol; insoluble in benzene

## Transport and Fate

Barium is extremely reactive, decomposes in water, and readily forms insoluble carbonate and sulfate salts. Barium is generally present in solution in surface or groundwater only in trace amounts. Large amounts will not dissolve because natural waters usually contain sulfate, and the solubility of barium sulfate is generally low. Barium is not soluble at more than a few parts per million in water that contains sulfate at more than a few parts per million. However, barium sulfate may become considerably more soluble in the presence

## Regulations and Standards

Interim Primary Drinking Water Standard: 1 mg/liter

OSHA Standard: 0.5 $mg/m^3$ (soluble compounds, as Ba)

ACGIH Threshold Limit Value: 0.5 $mg/m^3$ (soluble compounds, as Ba)

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Remedial Investigation Report: 8/27/92 Du Pont-Newport Site
DATE: 10-1-92

FROM: Randy Sturgeon, RPM
DE/MD Section

TO: File

Upon review of the above document, EPA has concluded that no further revision by Du Pont is necessary. However, EPA believes it is necessary to include the following comments to clarify several issues and/or express EPA's view point on several issues.

1. Attachment 1, page 5, comment 16 (regarding Section 3.2.3, page 3-7): Du Pont failed to address EPA's original comment. The small waste piles to the west for the north landfill show that terrestrial habitats affected at the Site are not limited to just the north and south landfills.

2. Attachment 1, page 17, comment 55: Du Pont failed to adequately respond to EPA's comment regarding the delineation of the north landfill in Figure 65. The 1937 and 1948 show definitively that the north landfill extended to near the three fire water basins. Field work has not disproved this.

3. Executive Summary, page ES-2, paragraph 1: The statement "all of the environmentally impacted or potentially impacted areas defined by the soils and groundwater media are located within the Site property boundaries" is false. for example, monitoring well MW-26BD (located on Necastro's property) has an MCL exceedance of tetrachloroethylene which is attributable to the Site. Also, the Human Health Evaluation determined that consumption drinking water from either the Columbia or the Potomac aquifers underneath Necastro's property is harmful to human health.

4. Executive Summary, page ES-3, paragraph 3: The list of constituents from the Environmental Evaluation (EE) is incomplete. Add arsenic, lead, copper, mercury, and chromium.

5. Executive Summary, page ES-10, paragraph 2 and Section 6.0, page 6-10, paragraph 3: The statement that the areal extent of impact is in "a worst case extends no further upstream than RS12 and no further downstream than just below the James Street Bridge" is potentially false. No sampling was done just downstream or just upstream from the Site to verify this claim. Although RS13 and RS14 are upstream from RS12 and demonstrate only minor contaminant loading from the Site, they may not be representative of the river and can not be used to conclusively state that no impacts are present upstream of RS12. The exact areal extent of impact warranting remediation will be determined during remedial design. See also the 9/23/92 memo on the Environmental Evaluation (comment 1) regarding EPA's definition of impacts.

6. Section 4.1, page 4-6, paragraph 1: The fact that 70 percent of the samples had cobalt above the range for northern Delaware (see Schacklette, 1984) indicates that cobalt is a contaminant at the Site. It should be noted that the other sampling locations listed by Schacklette between the Chesapeake Bay and the Delaware River have an even lower range for cobalt.

7. Section 4.4.1.3, page 4-27, paragraph 1: EPA has further reviewed the core data presented in the 8/28/88 Work Plan. The data do show that in the area adjacent to the north landfill, the sediment contaminant concentrations increase with depth. However, the surficial sediments were not sampled as part of these corings. The first sample was collected at the 1.0-1.5' depth, whereas a surficial sediment sample is collected at the 0-6" depth maximum. The results of the corings show that even the highest contaminant levels in the corings are lower than some of the surficial sediment data collected near the north river bank. For example, zinc is four to five times greater at RS11 and RS12 (note that at RS12 the 0-6" sample had ten times more zinc than the 6-12" sample) than any of the zinc data collected during the 1987 corings. While the available data does not prove that ground water is the source of the high surficial sediment concentrations at RS11 and RS12, the coring data definitely does not eliminate ground water as a source.

8. Figure 5A: In EPA's opinion, disposal was confined to the solid outline of the south landfill except that the landfill extended to the east of the current Basin Road. The area in the figure from south of the south landfill to the dotted line (current location of the berm) undoubtedly was, and probably still is, heavily contaminated through the spread of waste when the dikes around the original south landfill either broke or were breached.

9. Figure 12: This figure does not delineate the small wetland on top of the north landfill which is discussed in the EE (8/7/92).

10. Figure 38: See attached figure for EPA's modifications.

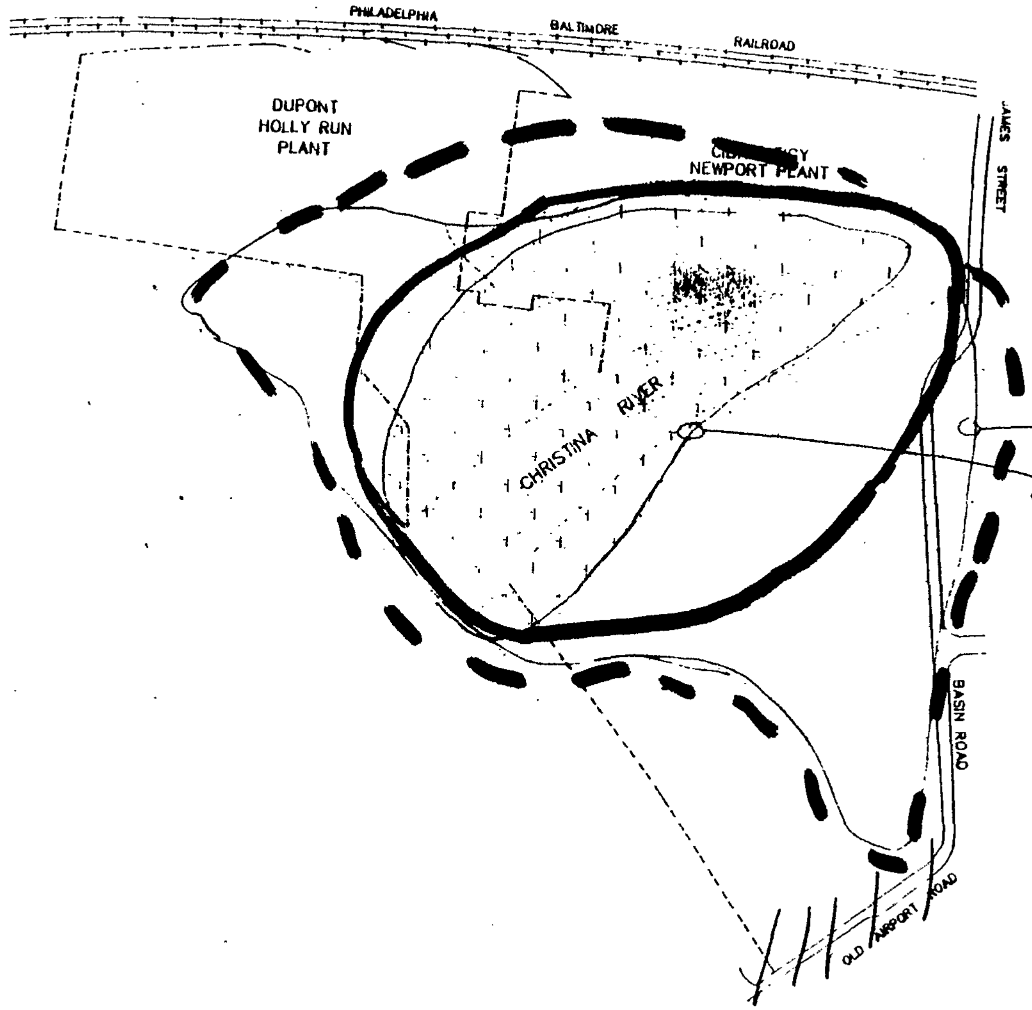
11. Section 4.3.3, page 4-21: Du Pont's calculations regarding the effect of Site-related ground-water discharges to AWQC exceedances (pages 4-20 and 4-21) show (assuming they are representative) that although the Site does not (in Du Pont's estimation) create by itself AWQC exceedances, the Site does significantly increase contaminant levels in the river. For example, Du Pont calculated that the Site-related zinc contribution to the river increased the zinc level in the river by over 30 ppb. When the AWQC is only 110 ppb (at 100 ppm hardness) and zinc levels in the river have been measured above 110 ppb, 30 ppb is a significant amount. Controlling the groundwater from the Columbia aquifer and the fill zone at the Site would significantly improve the water quality in the Christina River. The loadings presented in this report are much lower (one to two orders of magnitude) than those Du Pont presented in the Data Sufficiency Memorandum (4/27/89). In EPA's opinion, the calculations in the RI and in the 4/27/89 Data Sufficiency Memorandum represent the range of possible discharge loadings and that the Site may contribute much higher levels of contaminants to the river than the levels expressed in the example above.

12. See attached comments from the National Oceanic and Atmospheric Administration.

EPA MODIFICATION

SHALLOW

POTOMAC




LEGEND: DuPont's Boundary

BOUNDARY OF SHALLOW GROUNDWATER THAT EXCEED MCL's

BOUNDARY OF POTOMAC FORMATION GROUNDWATER THAT EXCEED MCL's

SHALLOW GROUNDWATER DELINEATION LINE
BASED ON MCL EXCEEDANCES FOR TOTAL BARIUM, TOTAL CADMIUM, TOTAL ARSENIC, TOTAL LEAD, TETRACHLOROETHYLENE, AND TRICHLOROETHYLENE FOR PHASE III SHALLOW GROUNDWATER.

POTOMAC FORMATION DELINEATION LINE
BASED ON MCL EXCEEDANCES FOR PHASE III POTOMAC FORMATION GROUNDWATER SAMPLES FOR TOTAL BARIUM, TOTAL ARSENIC, TOTAL CADMIUM, TOTAL LEAD, TETRACHLOROETHYLENE, AND TRICHLOROETHYLENE.

SHALLOW GROUNDWATER INCLUDES WELLS SCREENED IN THE FILL/OTHER QUARTERNARY AND/OR COLUMBIA FORMATION ZONES

/// - AREA OF CADMIUM EXCEEDANCE PRIOR TO PHASE III

| Rev. No | Date | Type of Revision | Checked by |
|---|---|---|---|

BOUNDARY OF GROUNDWATER
THAT EXCEED MCL'S
DuPONT - NEWPORT SITE
NEWPORT, DELAWARE

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No. 88C2078-4F | Drawing No. 807-8180 | Date: 08/31/1988
Drawn by: JP | Checked by: PTG
Scale:

FIGURE 3B

AR317398

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
Office of Ocean Resources Conservation and Assessment
Hazardous Materials Response and Assessment Division
Scientific Support Coordination Branch
7600 Sand Point Way NE, BIN C15700
Seattle, WA 98115

September 24, 1992

Mr. John R. Sturgeon (3HW42)
Office of Superfund Programs
U.S. EPA - Region III
841 Chestnut Street
Philadelphia, PA 19107

RE: Dupont Newport
Final Remedial Investigation
Report/Focused Feasibility Study
Dated August 27, 1992

Dear Mr. Sturgeon:

Thank you for the opportunity to review the Final Remedial Investigation Report/Focused Feasibility Study (FFS) for the DuPont -Newport Site. The following comments are submitted on behalf of the National Oceanic and Atmospheric Administration (NOAA). Sediment, surface water, and tissue samples collected from the Christina River and associated wetlands during remedial investigations indicate contamination associated with the DuPont-Newport site poses a significant threat to NOAA trust resources which use the Christina River and its wetlands for spawning and nursery grounds.

While the following comments appear to be extensive, they should not require the rewriting of the RI/FS as long as it is clear that these documents are being accepted with reservations.

## REMEDIAL INVESTIGATION

### Executive Summary

Page ES-12: Last bullet: There is no supporting evidence that RS15 is representative of background conditions in the Christina River and is not being influenced by another localized source of contamination. Some of the contaminants are actually found at lower concentrations in the vicinity of the Site than at RS15, suggesting at least some localized inputs in the vicinity of RS15. (see below)

**Section 4.1**

Page 4-3: First paragraph: The validity of comparing soil concentrations at the Site to the upper level of the range reported for the northeast U.S. by Shacklette (1984) is highly questionable (Table 10). The upper end of the range probably represent either soils that are associated with special geological conditions (e.g. ore deposits) or soils which have been subjected to anthropogenic enrichment. A more appropriate comparison would be to North Delaware soils, also listed in Table 10, which have reported concentrations an order of magnitude or more lower than the high end of the northeast U.S. range, or to U.S. averages as reported in Table 12 of the Risk Assessment, Volume 2 of 2, Environmental Evaluation dated August 7, 1992. If either of these values are used there would be far more reported exceedances.

**Section 4.4.1**

Page 4-23: Last paragraph: It has been stated in the past that there is no justification for using RS15 as a reference station for the other river stations and especially not for the wetlands stations. The data for RS15 indicates the conditions at RS15 only, not the background river conditions. If you want true background river conditions then several "clean" sites would need to be sampled and the mean concentrations calculated. The available data suggest that contaminants of concern are actually elevated at RS15 since RS13, RS14 and RS10 have consistently lower normalized concentrations than do RS15 (except lead at RS14). If RS13 and RS10 were used as a reference for RS15, then based on the normalized data the EF for RS15 were range from a little over 1.0 for nickel to just over 5.0 for mercury, with the EFs for arsenic, cadmium, chromium, lead and zinc falling between 3 and 4. This suggests, by the logic presented in this paragraph of the RI, that RS15 is subject to anthropogenic enrichment over background levels for these contaminants. It also suggests that the EFs for the other stations should be higher than reported.

**Section 4.4.1.1**

Page 4-24: Last sentence first paragraph: This and all other references to sediment EF values should be considered in light of the previous comment regarding RS15 and EF values.

Page 4-24: Second paragraph: *ibid.*

**Section 4.4.1.2**

Page 4-25: First and second paragraphs: *ibid.* The revised chromium EF for AS03 would be about 3, not below 1 as stated in the last sentence of the first paragraph, which **would** suggest anthropogenic enrichment.

**Section 4.4.1.3**

Page 4-26: Second full paragraph: This and all other references to sediment EF values should be considered in light of the previous comment regarding RS15 and EF values (comment on Section 4.4.1, Page 4-23).

Page 4-27: First and second full paragraphs: *ibid.*

Page 4-28: First and second full paragraphs: *ibid.*

Page 4-29: Last sentence first (partial) paragraph: The logic for why contaminant concentrations at RS10 are lower than at the reference station appears flawed. How can changes in hydrological conditions at stations RS05 and RS06 reduce the contaminant concentrations at RS10 to below background levels.

Page 4-30: First paragraph: This and all other references to sediment EF values should be considered in light of the previous comment regarding RS15 and EF values (comment on Section 4.4.1, Page 4-23).

**Section 4.4.2**

Page 4-30: Second paragraph: The amphipod test, which could not be analyzed for significance due to improperly run controls, did suggest toxicity at AS03.

**Section 4.4.3**

Page 4-31: Third paragraph: Last sentence appears to contradict the last sentence in the first paragraph of this section with regard to the station with the greatest richness of taxa.

General: Richness and density alone do not indicate whether a benthic community has been impacted by pollution. Diversity and dominant species also need to be taken into account. For example, you could have a benthic community with a relatively high number of different species (high richness) but with only one or two species making up the vast majority of the individual organisms present (low diversity) and further the dominant species may be pollution tolerant or pollution loving. Specifically, a community could consist of high densities of pollution tolerant tubifex worms with several other species represented by only a few individuals each. This community would have high richness and high density but the diversity would be low and the dominant species is pollution tolerant.

With regard to the statistical analysis they fail to state how powerful their statistical tests were, i.e. how big of a difference there had to be between sites before it would be considered significant.

**Section 4.5**

Page 4-33: First full paragraph, line 5: The sentence "Of the metals detected, only cadmium and copper exceeded literature values in two samples each." is misleading. It implies that only values exceeding values in the literature are of concern but since the values in the literature also include values from contaminated organisms (based on the literature references cited elsewhere) this is not true.

Page 4-34: Line 3: They do not indicate what they mean by non-essential metals. If biologically essential metals are present in excess of the needs of an organism they could prove to be toxic.

**Section 5.3.2**

Page 5-14: First full paragraph starting with "In addition...": The validity of the temporal variations discussed is this section is not clear. Since replicate samples were not taken at each site during each sampling event it is unclear whether this variation is truly temporal (i.e. due to changes in concentration with time) or simply within station variability resulting from slightly different locations for each individual sample. In other words if you don't know what the variability in contaminant concentrations is at time 1 at station 1 then you can't know if the difference in contaminant concentrations at time 1 and time 2 are due to changes in concentrations with time.

**Section 5.4**

Page 5-14: Last sentence is incorrect; "All of the metals of concern at the Site, except cadmium, are essential for normal biological functions and growth, and will be actively absorbed by both terrestrial and aquatic flora and fauna in the wetlands and River systems."

- The metals of concern as per the Environmental Evaluation (8/5/92) are: barium, cadmium, chromium, copper, lead, mercury and zinc.

- Only chromium, copper and zinc have biological functions; barium, cadmium, lead and mercury have no biological function.

- Cadmium is also readily taken up by biological organisms.

**Section 5.4.1**

Page 5-15: Line 14 of the first paragraph the sentence "Of the metals detected, only cadmium and copper exceeded literature values in two samples each." is misleading. It implies that only values exceeding values in the literature are of concern but since the values in the literature also include values from contaminated organisms this is not true.

Page 5-16: The last sentence of the first paragraph: "These results suggest that spatterdock and, perhaps other aquatic plants near the Site may be minor repositories for some metals during the growing season, but have little tendency to bioconcentrate metals of concern to levels greater than those in the surrounding sediment." is not justified by the preceding statements.

- Because the bioconcentration factors are approximately the same in the vicinity of the Site as at the reference station doesn't preclude the fact that the bioconcentration factor is significant.

- While it turns out that the bioconcentration factors are generally 1 or less with regard to total metal concentrations in sediments, the plants may be significantly concentrating the bioavailable portion of the sediment metals at levels of concern for the food chain.

**Section 5.4.2**

Page 15-6 This section is misleading; it misuses the term 'bioconcentration', and ignores the generally accepted fact that mercury undergoes biomagnification.

- Bioconcentration with regards to aquatic organisms is strictly based on the accumulation of contaminants directly from the water and doesn't take into account any accumulation from the ingestion of food items or comparison of contaminant concentrations in sediment to those in biota.

- The principal route of uptake in aquatic organisms of many inorganics is through ingestion of either food or sediment.

- Mercury in particular accumulates in aquatic organisms by ingestion of food items and has a strong tendency to biomagnify as it progresses up the food chain.

- The term 'bioconcentration' in this section should be changed to 'bioaccumulation'. Bioaccumulation is the net result when the uptake of a chemical (by any means) by a biological organism exceeds the depuration of the chemical from the organism. The data does indicate that bioaccumulation of inorganics occurs at the Site (i.e. biota in the vicinity of the Site have elevated levels of contaminants).

**Section 6.**

Page 6-4: First bullet: The validity of comparing soil concentrations at the Site to the upper level of the range reported for the northeast U.S. by Shacklette (1984) is highly questionable (Table 10). The upper end of the range probably represent either soils that are associated with special geological conditions (e.g. ore deposits) or soils which have been subjected to anthropogenic enrichment. A more appropriate comparison would be to North Delaware soils, also listed in Table 10, which have reported concentrations an order of magnitude or more lower than the high end of the northeast U.S. range, or to U.S. averages as reported in Table 12 of the Risk Assessment, Volume 2 of 2, Environmental Evaluation dated August 7, 1992. If either of these values are used there would be far more reported exceedances.

Page 6-5: First bullet, last sentence: *ibid.*

Page 6-6: First bullet: The amphipod test did suggest toxicity at AS03 ; it had only 15% survival which was significantly different than other stations tested. Since the controls were improperly run, significance with respect to the controls could not be determined. The tests should have been rerun and should be used for any future monitoring.

Page 6-10: First bullet, next to last sentence: The statement that "....sediment chemistry improves markedly with distance from the berm...." is not justified based on the data which consists of three points for sediment chemistry (which were

Page 6-12: First full sentence: If the plants have taken up contaminants then by definition the contaminants were bioavailable.

Page 6-12: First bullet: It has been stated in the past that there is no justification for using RS15 as a reference station for the other river stations and especially not for the wetlands stations. The data for RS15 indicates the conditions at RS15 only, not the background river conditions. If you want true background river conditions then several "clean" sites would need to be sampled and the mean concentrations calculated. The available data suggest that contaminants of concern are actually elevated at RS15 since RS13, RS14 and RS10 have consistently lower normalized concentrations than do RS15 (except lead at RS14). While it is not valid to compare data from the Site to RS15 in order to determine the degree of contamination and environmental impact at the Site, there is sufficient data to determine that the Site is contaminated and remediation needs to be performed. The actual extent of remediation is yet to be determined and will be expected to be based on additional chemical analyses in the river and wetlands.

## FOCUSED FEASIBILITY STUDY

### General

The Environmental Evaluation considered areas downstream of the James Street Bridge non-impacted because impacts to aquatic receptors could not be attributed solely to the DuPont Newport site. The FFS addresses the areas shown previously to be impacted or potentially impacted by site-related contamination. The FFS acknowledges that the extent of environmental impact has not been adequately defined for purposes of remediation. Information on how the zone of impact will be defined or on how cleanup levels will be determined is not provided, except to state that the remedial design phase will likely include benthic surveys to more accurately define the areas of impact and extent of sediment removal. The Remedial Design will need to include a detailed analysis of the effects of remediation versus impacts associated with contamination in order to determine cleanup levels not located on a line extending form the berm) and only two points for toxicity data.

Page 6-10: Second bullet: It has been stated in the past that there is no justification for using RS15 as a reference station for the other river stations and especially not for the wetlands stations. The data for RS15 indicates the conditions at RS15 only, not the background river conditions. If you want true background river conditions then several "clean" stations would need to be sampled and the mean concentrations calculated. The available data suggest that contaminants of concern are actually elevated at RS15 since RS13, RS14 (also upstream from the site) and RS10 have consistently lower normalized concentrations than do RS15 (except lead at RS14). If RS13 and RS10 were used as a reference for RS15, then based on the normalized data the EF for RS15 were range from a little over 1.0 for nickel to just over 5.0 for mercury, with the EFs for arsenic, cadmium, chromium, lead and zinc falling between 3 and 4. This suggests, by the logic presented in this paragraph of the RI, that RS15 is subject to anthropogenic enrichment over background levels for these contaminants. It also suggests that the EFs for the other stations should be higher than reported. Revised EFs for copper at RS11 and RS12 would be around 10 not 5. A revised mercury EF at RS11 would be 16, the highest of any river station.

Page 6-10: Third bullet: The approach is not considered valid for mercury, because it represents a bioaccumulation problem resulting in sublethal effects rather than a direct toxicity problem.

Page 6-11: First paragraph, last sentence: Because of all the assumptions, some of which weren't fully justified, it is questionable whether the data is sufficient to justify the statement "....none of the measured concentrations of ecological constituents of concern are considered to pose significant risk or the potential for acute toxic reactions....".

Page 6-11: Third bullet, first sentence: Plants only act as temporary sinks for contaminants because seasonal senescence (e.g. lose of above ground vegetation) and decay, thus releasing contaminants back to the environment.

that will be most protective of trust resources. The Remedial Design workplan should be reviewed by NOAA when it is available.

Remedial goals need to be more specific to ecological resources. Specific accomplishments of each goal need to be listed and discussed.

**Executive Summary**

page ES-4 Paragraph 1, next to least sentence: As reiterated previously the choice of reference station is not considered to be representative of background conditions. Therefore, while RS06 may have had the same or better survival results than the reference station, this does not mean that RS06 has not been impacted by the site.

page ES-4 Paragraph 4: Overall risk to terrestrial and wetland wildlife is considered low because the highest hazard index was calculated to be 1.7. However, the hazard quotient approach in environmental risk assessments does not include the same margins of protection afforded during human health risk assessments. A hazard quotient (or index) greater than 1 implies effects will occur. A hazard index of 1.7 in not small. If the risk assessment were conducted using more conservative numbers (for example, using the lowest observed effects levels instead of median values) hazard indices would have been much higher.

**Section 1.5.5.**

page 1-17 Last paragraph, last sentence: The contention that past disposal practices (and not groundwater seepage) resulted in the river contamination is based on the fact that the surface sediments are less contaminated than the underlying layer, and that there is not a consistently high enrichment of metals between the north drainageway and the bridge. Also, groundwater enrichment is stated to be different than metals enrichments seen in the river. As a relative source, historical disposal practices may have been greater than groundwater seepage. However, these factors do not necessarily imply that groundwater contamination is **not** currently contributing to the contamination of the river sediments.

If you have any questions regarding these comments feel free to contact either one of us.

Sincerely,

Peter Knight

Donald A. MacDonald

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

SUBJECT: Focused Feasibility Study (8/27/92) Du Pont-Newport Site

DATE: 10-7-92

FROM: Randy Sturgeon, RPM DE/MD Section

Randy Sturgeon

TO: File

1. Executive Summary, page ES-4, paragraph 4: EPA agrees that the findings of the terrestrial risk assessment did not alter the remedial goals at the Site. However, monitoring of muskrats in the south pond is warranted as part of the RD/RA since the sensitivity analysis showed that by using more conservative assumptions than used by Du Pont, extreme impacts were predicted. Monitoring is the only way to verify the risk assessment and to determine the actual level of impact.

2. Executive Summary, page ES-19, bullet 7: The shallow groundwater discharge <u>does</u> substantially contribute to Site-related constituents in the surface water. Du Pont's calculations regarding the effect of Site-related ground-water discharges to AWQC exceedances (pages 4-20 and 4-21 of the Remedial Investigation Report 8/27/92) show (assuming they are representative) that although the Site does not create (in Du Pont's estimate) by itself AWQC exceedances in the river, the Site does significantly increase contaminant levels. For example, Du Pont calculated that the Site-related zinc contribution to the river increased the zinc level in the river by over 30 ppb. When the AWQC is only 110 ppb (at 100 ppm hardness) and zinc levels in the river have been measured above 110 ppb, 30 ppb is a significant amount. Controlling the groundwater from the Columbia aquifer and the fill zone at the Site would significantly improve the water quality in the Christina River. The loadings presented in the Remedial Investigation Report (RI) are much lower (one to two orders of magnitude) than those Du Pont presented in the Data Sufficiency Memorandum (4/27/89). In EPA's opinion, the calculations in the RI and in the 4/27/89 Data Sufficiency Memorandum represent the range of possible discharge loadings and that the Site may contribute much higher levels of contaminants to the river than the levels expressed in the example above. Therefore controlling the groundwater discharge from the Columbia aquifer and the fill zone is a remedial goal at this Site. Also note that AWQC



AR317410

exeedances are prevalent throughout the wetlands. Ground water is a major cause of this.

3. Executive Summary, page ES-20, bullet 8: EPA considers the groundwater recovery system in the town of Newport feasible.

4. Section 1.5.5, page 1-17 and 1-18: EPA has further reviewed the core data presented in the 8/28/88 Work Plan. The data do show that in the area adjacent to the north landfill, the sediment contaminant concentrations increase with depth. However, the surficial sediments were not sampled as part of these corings. The first sample was collected at the 1.0-1.5' depth, whereas a surficial sediment sample is collected at the 0-6" depth maximum. The results of the corings show that even the highest contaminant levels in the corings are lower than some of the surficial sediment data collected near the north river bank. For example, zinc is four to five times greater at RS11 and RS12 (note that at RS12 the 0-6" sample had ten times more zinc than the 6-12" sample) than any of the zinc data collected during the 1987 corings. While the available data does not prove that ground water is the source of the high surficial sediment concentrations at RS11 and RS12, the coring data definitely does not eliminate ground water as a source.

5. Section 1.5.5, page 1-18, paragraph 2: The locations of RS05 and RS06 do not coincide with a drainage way that originated in the south disposal site. That particular drainage way emptied further downstream of these sampling stations at a point in the Christina River that no longer exists due to re-routing of the river to install the interstate system.

6. Section 2.1, page 2-2: EPA has not thoroughly reviewed this section on ARARs and TBCs to definitively state whether or not this section is accurate and complete. The Record of Decision will be accurate and complete in its discussion of ARARs and TBCs. Attached are the ARARs identified by the State of Delaware.

7. Attached are several other alternatives that were not analyzed in the FFS. One involves excavation of the portion of the south landfill underneath and to the east of Basin Road. The other involves remediation of the Columbia aquifer underneath the south wetlands.

8. EPA does not agree with the preferred alternative presented by Du Pont. The forthcoming proposed plan for the Site will outline EPA's preferred alternative.

[redacted]

Remediation Alternative 1:

Excavation of waste material up to the eastern edge of the estimated disposal boundary and consolidation in the South Disposal Site using in-situ immobilization technique.

Description:

This alternative involves the excavation of all waste material underneath Basin Road and James Street and beyond, up to the eastern edge of the estimated boundary of the disposal area. The excavated material will be transferred to the South Disposal Site area and consolidated by in-situ immobilization. Basin Road will be restored back after the completion of excavation.

The volume of waste material to be excavated is estimated to be approximately 36,810 cubic yards. This estimation is based on aerial extent provided in Figure 5A (attached) of the Remedial Investigation Report and average depth of eight feet. Dupont has used eight feet as the average depth to estimate the volume of waste material in the South Disposal Site. Removal of waste material from underneath the Basin Road and adjacent area will eliminate potential exposure to workers involved in road construction or repair, which may involve excavation in these areas. With the removal of waste material there will be no restrictions on construction activities in this area, and providing overall protection to human health and environment. Removal of waste material will eliminate the potential source of groundwater contamination. If the waste material is left in place, the infiltrating rain water may carry contaminants of concern to the groundwater. The short term impacts involving exposure to workers during remediation can be greatly reduced by employing adequate health and safety measures.

In-situ immobilization of the excavated material in the South Disposal Site will greatly reduce the mobility of contaminants, thus reducing the impact to the groundwater. This alternative can be easily implemented by numerous vendors in this area using standard engineering construction practices.

The major component of cost to implement this remedy is the excavation and transportation of waste material from underneath the road. The capital cost to implement this alternative is provided as an estimate in Table 1.0. No operation and maintenance costs were developed for this alternative. The operation and maintenance costs are the same as Alternative SDS-5 presented in the Focused Feasibility Study.

TABLE 1.0

Alternative 1.0: Excavation and Transportation of Waste Material Underneath the Bridge Road

| Item Description | Quantity | Unit | Unit Cost $ | Cost $ |
|---|---|---|---|---|
| Excavation of waste material | 36,810 | CY | 15 | 552,150 |
| Backfilling, compaction and regrading | 36,810 | CY | 20 | 736,200 |
| Resurfacing the road with asphalt blacktop | 33,300 | sq. ft. | .50 | 16,650 |
| Transportation of waste material | 36,810 | CY | 1.0 | 36,810 |
| In-situ stabilization | 36,810 | CY | 38 | 1,398,780 |
| Total Direct Cost (DC) | | | | 2,740,590 |
| MOB and DeMOB (10% of DC) | | | | 274,000 |
| Health and Safety (5% of DC) | | | | 137,000 |
| Engineering Costs (15% of DC) | | | | 421,800 |
| **Subtotal** | | | | 3,572,590 |
| Contingency (20%) | | | | 714,500 |
| **Total Capital Cost** | | | | 4,287,090 |

**Basis for Cost Estimation**

1) Excavation costs are based on Richardsons Estimating Guide standard. This cost assumes clear access to the location and requires no permits.

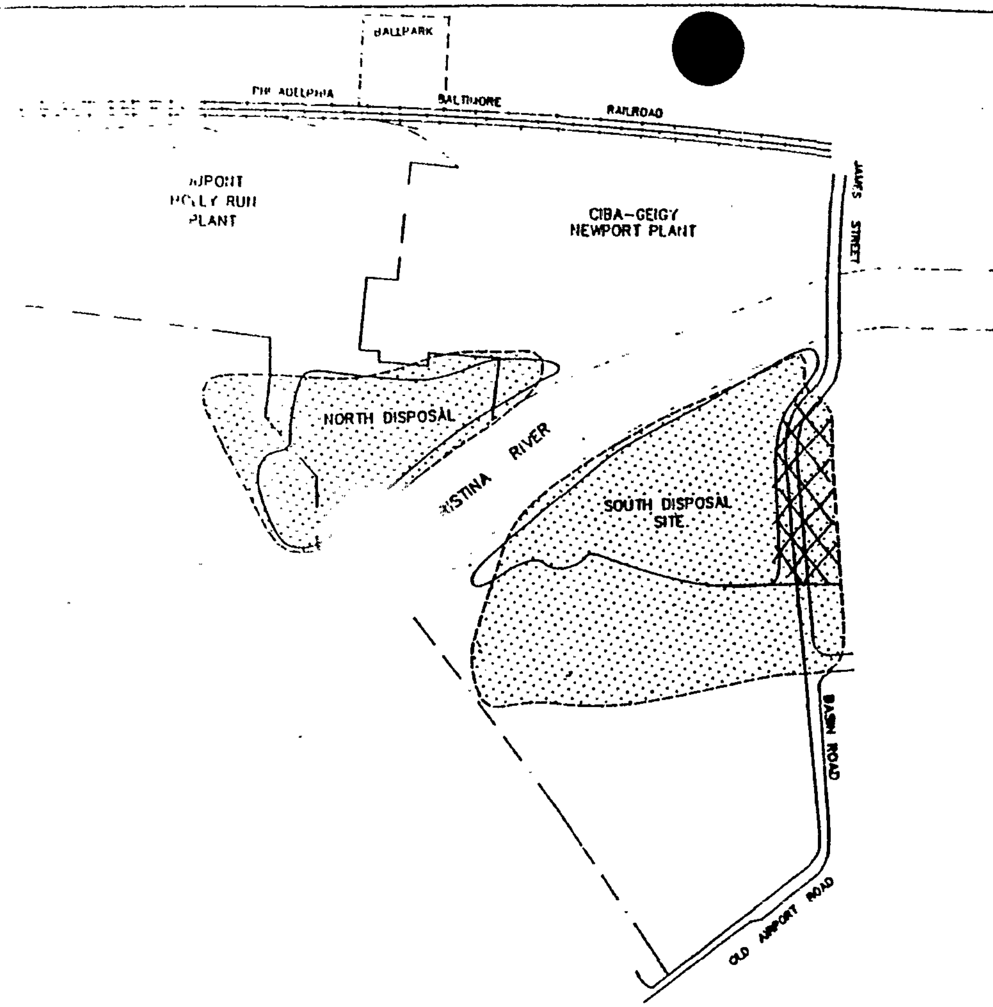
2) The cost of backfilling includes a material cost of $15.00/cubic yard for the gravel material.

3) The road surface requiring asphalt is based on length of 1,100 feet and width of 30 feet.

4) Transportation costs assume that hauling will be no greater than 1 mile.

5) In-situ stabilization costs are taken from the Table H-15 of the Focused Feasibility Study report dated August 27, 1992.

6) All non-direct costs are based on percentages considered in the Focused Feasibility Study Report.




LEGEND:

ESTIMATED BOUNDARY OF DISPOSAL BASED ON AERIAL PHOTOGRAPHS REVIEW (1937-1977)

AREA OF EXCAVATION

| Rev. No. | Date | Type of Revision | Checked by |
|---|---|---|---|
| | | | |

ESTIMATED AREAL EXTENT OF
DISPOSAL ACTIVITIES
DuPONT - NEWPORT SITE
NEWPORT, DELAWARE

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

FIGURE 5A

AR317415

[redacted]

Remedial Alternative 2:

Hydraulic Barrier, Low Permeability Cap over the Landfill, Groundwater Recovery and Treatment System.

Description:

This remedial alternative is an extension of the Alternative SDS-4 presented in the Focused Feasibility Study report dated August 27, 1992. In this alternative, the location of hydraulic barrier is moved up further north, along the southern edge of the South Disposal Site and additional excavation wells have been included to address the groundwater plume underneath the wetlands. The objective of this alternative is to:

- significantly reduce the continued flow of contaminated groundwater in the shallow and Columbia formations beyond the southern edge of the South Disposal Site;

- remediate the plume of contaminated groundwater existing underneath the wetlands south of the South Disposal Site.

The conceptual plan to achieve these objectives is as follows:

- Install a hydraulic barrier in the form of a series of extraction wells at the rim of the southern toe of the South Disposal Site. (This is very similar to the system proposed by Dupont in Alternative SDS-4);

- Install a series of extraction wells to capture the entire plume of contaminated groundwater and provide treatment to the extracted groundwater prior to disposal into the wetlands;

- Install a low permeability cap over the South Disposal Site to minimize the infiltration of precipitation.

As a part of the hydraulic barrier system, Dynamac proposes six extraction wells (SP-1 through SP-6) as shown on attached Figure 1. As can be seen from the figure, three of these wells are located right along the southern toe of the South Disposal Site, while the other three are located along the eastern boundary of the South Disposal Site. Six additional wells (SP-7 through SP-12) have been proposed to extract the contaminated plume of groundwater underneath the wetlands. See Figure 1 for the location of these wells.

In order to estimate the pumping rate radii of capture and the time frame of remediation, Dynamac has used the data presented by Dupont in Appendix C of the Focused Feasibility Study.

The following assumptions were made in determining the number and locations of extraction wells:

- The pumping rate of 2.5 gpm per well;

- The radii of influence at the above pumping rate was approximately 165 feet;

- The total areal extent of the plume south of the South Disposal Site is approximately 16.5 acres (720,000 square feet) as depicted on Figure 38 of the Remedial Investigation report dated August 26, 1992;

- The aquifer depth is 18 feet as denoted on Table C 3-1 of the FFS report;

- The porosity of the aquifer is assumed to be 0.3.

This alternative will effectively reduce the flow contaminated groundwater beyond the southern edge of the South Disposal Site thus eliminating adverse environmental impact on the wetlands. The hydraulic barrier system proposed by Dupont in Alternative SDS-4 would allow the groundwater to flow the wetlands beyond the southern edge of the South Disposal Site. The removal of contaminated plume of groundwater will prevent potential migration contaminants beyond the Site boundaries thus reducing the potential risk associated with direct contact exposure and ingestion. It is estimated that it will take approximately 3.8 years to flush one pore (aquifer) volume of contaminated plume underneath the wetlands using the above proposed extraction system. Based on the current levels of contaminants in the plume at least 5 to 6 flushes may be necessary to restore the aquifer to MCLs. The cleaning aquifer will provide overall protection to human health and environment. The hydraulic barrier system may need to be operated for a long period. The short term impact of this alternative may include disruption of wetlands due to the construction of wells, etc. The extraction of groundwater may result in dewatering of wetlands, which can be mitigated by disposing the treated groundwater on to the wetlands. The groundwater treatment may be required for both inorganic and organic constituents.

The capital cost, operation and maintenance costs are presented in Table 2.0. These costs are basically the same as presented in Tables H-14 and H-14A of the FFS report. These tables have been modified to include costs associated with installation of additional extraction wells. All the assumptions made by Dupont in developing these are considered for this cost estimation.

TABLE 2.0

South Disposal Site Alternative 2 - Institutional Controls - Access Road Improvements
Low Permeability Cover - Hydraulic Controls
Preliminary Cost Estimate - Dupont Newport Site

| Item Description | Quantity | Unit | Unit Cost $ | Cost $ |
|---|---|---|---|---|
| Low Permeability Cover System | | | | |
| Regrade Area | 56,300 | sy | 1 | 56,300 |
| Clay Product Purchase & Installation | 506,700 | sf | 0.75 | 380,000 |
| Geomembrane Purchase & Installation (40 mil) | 506,700 | sf | 0.40 | 202,700 |
| Drainage Layer Purchase & Placement (12 in.) | 18,800 | cy | 15 | 282,000 |
| Geotextile Purchase & Installation | 56,300 | sy | 1.40 | 78,800 |
| Select Fill Purchase & Placement (6 inches) | 28,150 | cy | 10 | 281,500 |
| Vegetative Soil Purchase & Placement (6 in.) | 9,400 | cy | 15 | 141,000 |
| Hydroseeding | 56,300 | sy | 0.27 | 15,200 |
| **Subtotal** | | | | 1,437,500 |
| Access Road Construction | | | | |
| Regrading | 8,000 | sy | 1 | 8,000 |
| Gravel Base Purchase & Placement (12 inches) | 2,100 | cy | 15 | 31,500 |
| Erosion Control Product Purchase & Installation | 8,000 | sy | 0.50 | 4,000 |
| **Subtotal** | | | | 43,500 |
| Hydraulic Controls | | | | |
| Well Installation (35 feet deep) | 12 | each | 6,200 | 74,400 |
| Pump Installation | 12 | each | 2,500 | 30,000 |
| **Subtotal** | | | | 104,400 |
| Metals Precipitation Water Treatment System* | | | | |
| Reactor Module | -- | -- | lump sum | 100,000 |
| Equalization Module | -- | -- | lump sum | 25,000 |
| Clarifier Module | -- | -- | lump sum | 75,000 |
| Filterpress Module | -- | -- | lump sum | 50,000 |
| Installation | -- | -- | lump sum | 30,000 |
| Startup & Operator Training | -- | -- | lump sum | 20,000 |
| **Subtotal** | | | | 300,000 |
| Organics Water Treatment System | | | | |
| Air Stripping Tower/Off-Gas Treatment | -- | -- | lump sum | 100,000 |
| **Subtotal** | | | | 100,000 |

TABLE 2.0 (cont'd.)

| Item Description | Quantity | Unit | Unit Cost $ | Cost $ |
|---|---|---|---|---|
| Institutional Controls | | | | |
| Vegetative Barrier (1,060 L.F.) | 430 | plant | 24.50 | 10,500 |
| Fencing - 6 ft. with barbed wire | 920 | L.F. | 15.50 | 14,300 |
| Gate Entrance (Old Airport Road) - 6 ft. | -- | -- | 785 | 785 |
| Property Line Vegetative Barrier (1,530 L.F.) | 620 | plant | 24.50 | 15,200 |
| **Subtotal** | | | | 40,800 |
| Culvert for Discharge from Pond (48" dia.) | 80 | L.F. | 93 | 7,400 |
| **Total Direct Cost (DC)** | | | | 2,033,600 |
| Mobilization and Demobilization (10% of DC) | | | | 203,400 |
| Health and Safety (5% of DC) | | | | 101,700 |
| Engineering Costs (15% of DC) | | | | 305,100 |
| **Subtotal** | | | | 2,643,800 |
| Contingency (20%) | | | | 528,700 |
| **Total Capital Cost** | | | | 3,172,600 |
| Operation and Maintenance Costs | | | | |
| Access Road and Fencing/Barrier Maintenance | | | | 42,100 |
| Low Permeability Cover System Maintenance | | | | 223,700 |
| Well/Pump Maintenance | | | | 347,600 |
| Water Treatment System | | | | 6,948,300 |
| **Total O&M Present Worth Cost** | | | | 7,561,700 |
| **TOTAL PRESENT WORTH COST** | | | | 10,734,300 |

Note: Costs were generated based on 1992 dollars.

* For the cost estimation proposed Dupont sized the treatment systems for flow rate of 100 gpm. Even with the addition of 5 wells, the flow rate is expected to be lower than 100 gpm, hence the size of the treatment systems was not changed in this analysis even though additional wells were added in this analysis.

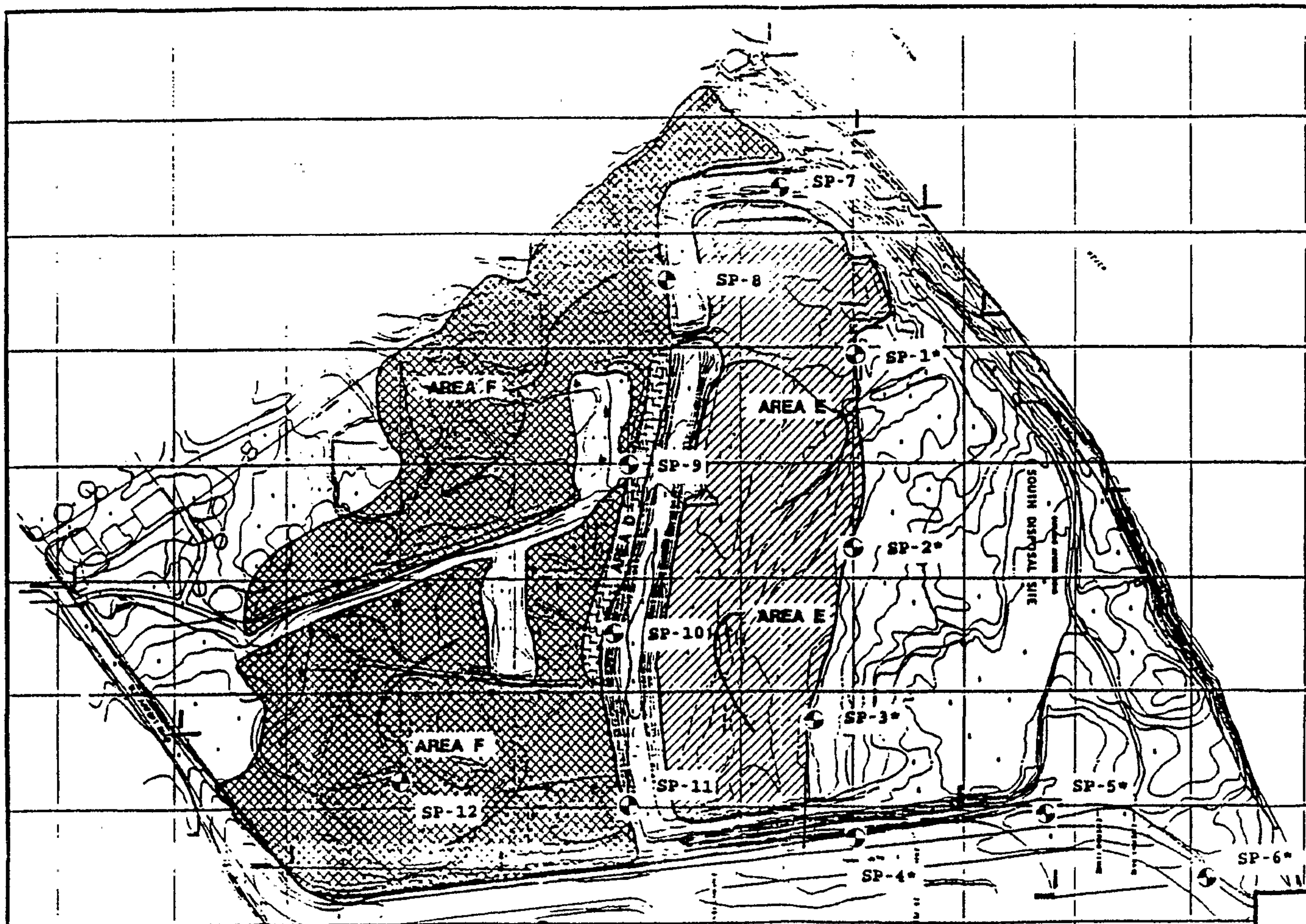



FIGURE 1: ALTERNATIVE 2 RECOVERY WELL LOCATIONS

ALTERNATIVES SW-2, SW-3 AND SW-4
CONCEPTUAL PLAN
FOCUSED FEASIBILITY STUDY
DUPONT-NEWPORT SITE
NEWPORT, DELAWARE

Woodward-Clyde Consultants
Consulting Engineers, Geologists and Environmental Scientists

Job No. | Drawing No. | Date
Drawn by | Checked by | FIGURE
Scale

AR317420

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
AND ENVIRONMENTAL CONTROL
DIVISION OF AIR AND WASTE MANAGEMENT
715 GRANTHAM LANE
NEW CASTLE, DELAWARE 19720-4801

WASTE MANAGEMENT SECTION
SUPERFUND BRANCH

TELEPHONE: (302) 323-4540
FAX: (302) 323-4561

September 18, 1992

Mr. Randy Sturgeon (3HW42)
U.S. EPA, Region III
841 Chestnut Building
Philadelphia, PA 19107

RE: State of Delaware Application Relevant and Appropriate Requirements (ARARs)
DuPont Newport Superfund Site
Newport, New Castle County, Delaware

Dear Mr. Sturgeon:

Attached is a list of Applicable Relevant and Appropriate Requirements (ARARs) for the State of Delaware. The Department of Natural Resources and Environmental Control (DNREC) is providing this information at the request of the U.S. Environmental Protection Agency (EPA).

The format used is as follows: Each ARAR listing is composed of five elements: 1) ARAR name; 2) Legal citation; 3) Applicable Relevant and Appropriate, or To Be Considered designation; 4) Description of requirement; and 5) Description of applicability to proposed remedial action.

These ARARs were developed using the draft Proposed Plan for the site as a basis. Please recognize that exact specific requirements for each remedial option must be developed in detail during the Remedial Design phase of the project. Please note also that, as the draft proposed plan develops, the attachment may need to be revised accordingly. This attachment assumes that EPA has included Applicable Relevant and Appropriate Requirements of the Delaware River Basin Commission in its total ARAR list.

If you have any questions about the attachment, please contact me at (302) 323-4540.

Sincerely,

Anne V. Hiller

Anne V. Hiller
Environmental Scientist III
Superfund Branch

AVH:dw
AVH92064.wp

Attachment

pc: N. V. Raman
K. Kalbacher
P. Ludzia

*Delaware's good nature depends on you!*

AR317421

# APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)
# DUPONT NEWPORT SUPERFUND SITE

I. **Chemical Specific**

A. **Water**

1. State of Delaware Regulations Governing Drinking Water Standards, Rev. 5/89
16 Del. Code Part 122
Applicable
- Sets criteria for public drinking water supply.
- May affect the establishment of public water service to residents along Old Airport Road.

2. Delaware Water Quality Standards
State of Delaware Surface Water Quality Standards, amended 2/2/90
Applicable
- Criteria to maintain surface water quality consistent with public health and recreational purposes, the propagation and protection of fish and aquatic life and other beneficial uses of water.
- Applicable should the remedial action involve discharge to surface water or should contaminated groundwater continue to discharge from the site into the Christina River..

B. **AIR**

1. Ambient Air Quality Standards
7 Del. Code Chapter 60
Regulation 3, Section 6003
Applicable
- Establishes ambient air quality standards.
- Applicable for treatment of groundwater by air stripper and for any excavation work that may occur.

II. **Location Specific**

A. **Water**

1. Wetlands Regulations
7 Del. Code Chapter 66
Applicable
- Requires activities that may adversely affect wetlands in Delaware to be permitted.
- Applicable for proposed wetlands remediation work.

2. Regulations Governing the Use of Subaqueous Lands, amended 9/92
7 Del. Code Chapter 72
Applicable
- Requires activities that affect public or private subaqueous lands in the State to be permitted.
- Applicable for remediation involving riverbank erosion control, dredging, or capping of the Christina River.

3. Delaware Coastal Zone Act, amended 7/92
7 Del. Code Chapter 7
Relevant and Appropriate
- Controls the location, extent and type of industrial development in Delaware's coastal areas.
- Should be considered for consistency.

B. Sediments
Executive Order 56 on Freshwater Wetlands (1988)
(Including Governor's Roundtable Report on Freshwater Wetlands, 1989)
To Be Considered
- General policy to minimize the adverse effects to freshwater wetlands.
- To be considered in determining extent and type of wetlands remediation and restoration.

III. Action Specific

A. Water

1. State of Delaware Regulations Governing the Construction of Water Wells
7 Del. Code Chapter 60
Applicable
- Contain requirements governing the location, design, installation, use, disinfection, modification, repair, and abandonment of all wells and associated pumping equipment.
- Applicable for potential monitoring, recovery, and reinjection wells.

2. State of Delaware Regulations for Licensing Water well Contractors, Pump Installers, Contractors, Well Drillers, Well Drivers, and Pump Installers
7 Del. Code Chapter 60
Applicable
- Regulations for examining and licensing those persons engaged in the contracting for the drilling, boring, coring, driving, digging, construction, installation, removal, or repair of water wells or water test wells or the installation or removal of pumping equipment in and for a water well or water test well.
- Applicable for potential installation, removal or repair of water or water test wells and their associated pumping.

3. Delaware Water Quality Standards
State of Delaware Surface Water Quality Standards as amended 2/2/90
Applicable
- Established to regulate discharge onto state waters in order to maintain integrity of the water.
- Applicable for discharge of treated groundwater or surface water.

4. Regulations Governing the Allocation of Water
7 Del. Code Chapter 60
Applicable
- Contain information pertaining to water allocation permit and criteria for their approval.
- May be applicable for potential groundwater recovery system or alternate water supply.

5. State of Delaware Groundwater Management Plan
7 Del. Code
To Be Considered
- Set policy for groundwater management.
- To be considered for determining the goals of groundwater quality.

6. Delaware Regulations Governing Control of Water Pollution
7 Del. Code Chapter 60
Applicable
- Contain water quality regulations for discharge into surface and groundwater of the State of Delaware.
- Applicable for potential discharge of treated groundwater or surface water. Also applicable for stormwater runoff into the Christina River.

7. State of Delaware Regulations Governing Public Drinking Water Systems
16 Del. Code Section 122
Applicable
- Establishes requirements for public drinking water supplies.
- May affect the establishment of public drinking water service to residents along Old Airport Road.

8. Regulations for Licensing Operators of Wastewater Facilities
7 Del. Code Section 6023(f)
Applicable
- Establishes requirements for the licensing and qualifications of operators of wastewater treatment facilities.
- Applicable for if treatment facility required for treatment of groundwater or surface water.

B. Sediments/Solids

1. Regulations Governing the Use of Subaqueous Lands
7 Del. Code Chapter 72
Applicable
- Requires activities that affect public or private subaqueous lands in the State to be permitted.
- Applicable for remedial activities involving riverbank erosion control, dredging and capping of the Christina River.

2. Delaware Sediment and Stormwater Regulations
7 Del. Code Chapter 40
Applicable
- Establishes a statewide sediment and stormwater management program.
- If developments or construction disturb more than 5,000 square feet of land, an approved stormwater and sediment management plan must be obtained.

3. Wetlands Regulations
7 Del. Code Chapter 66
Applicable
- Requires activities that may adversely affect wetlands in Delaware be permitted.
- Applicable for proposed wetlands remediation, especially restoration and replacement.

4. Delaware Regulations Governing Hazardous Waste
7 Del Code Chapter 63
Applicable
- Establishes requirements governing hazardous waste.
- Applicable to any remedial activities involving hazardous waste.

5. Identification and Listing of Hazardous Wastes
Delaware Regulations Governing Hazardous Wastes Part 261
Applicable
- Identifies solid wastes which are regulated as hazardous wastes.
- Applicable for the determination of regulation as hazardous waste for material involved in the remedial activities at the site.

6. Standards Applicable to Generators of Hazardous Waste
Delaware Regulations Governing Hazardous Waste Part 262
Applicable
- Establishes standards for generators of hazardous waste.
- Applicable to waste generated during implementation of remedial action.

7. Standards Applicable to Transporters of Hazardous Waste
Delaware Regulations Governing Hazardous Waste Part 263
Applicable
- Establishes standards for transporters of hazardous waste.
- Applicable to transporters of hazardous waste from site if part of remedial action.

8. Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities
Delaware Regulations Governing Hazardous Waste Part 264
Applicable
- Establishes standards for owners of facilities for treatment, storage and disposal of hazardous waste.
- Applicable to owners of hazardous waste treatment, storage and disposal facilities, particularly for disposal of hazardous waste off-site. Relevant and appropriate for construction of landfill caps.

9. Land Disposal Restrictions
Delaware Regulations Governing Hazardous Waste Part 268
Applicable
- Identifies hazardous wastes that are restricted from land disposal and defines those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.
- Applicable for potential on-site disposal of hazardous waste as a result of the remedial action.

10. The Hazardous Waste Permit Program
Delaware Regulations Governing Hazardous Waste Part 122.
Applicable
- Requires a permit for the treatment, storage or disposal of any hazardous waste as identified or listed in Part 261.
- May be applicable for proposed remedial action.

11. Regulations Governing Solid Waste
7 Del. Code Chapter 60
Applicable
- Establishes regulations to implement an improved solid waste management program.
- Applicable for transport and/or disposal of non-hazardous material during the remedial activities.

C. Air

1. Delaware Regulations Governing the Control of Air Pollution
7 Del. Code Chapter 60, Section 6003, Regulation 2, Section 2.4
Applicable
- Sets forth requirements that a permit is necessary to operate an air stripper if emissions exceed 2.4 lbs/day. -If emissions exceed the limit, then substantive requirements of the regulation must be met. In addition, air stripper emissions must meet the Ambient Air Quality Standards set forth in 7 Del Code, Chapter 60, Regulation 3, Section 6003.
- Applicable for proposed treatment of groundwater during the remedial action.

D. Miscellaneous

1. Delaware Environmental Protection Act
7 Del. Code Chapter 60
Applicable
- Policy for the development, utilization, and control of all water, underwater, land and air resources of the State of Delaware.
- Applicable for proposed remedial actions.

2. Delaware Radiation Control Regulations
16 Del. Code 7405
Applicable
- Establishes regulations for registration of facilities, licensing of materials, standards of protection, safety requirements, and notification requirements.
- May be applicable for work on the North landfill due to radioactive waste disposed of in this portion of the site.

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